



APPLICATION NO. 09/826,117

TITLE OF INVENTION: Hybrid Walsh encoder and decoder for CDMA  
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## CLAIMS

### WHAT IS CLAIMED IS:

10 7. A means for the design and implementation of encoders  
and decoders for Hybrid Walsh complex orthogonal CDMA  
channelization codes over a frequency band with properties

15 inphase (real) codes are equal to a lexicographic  
reordering permutation of the Walsh code

quadrature (imaginary) codes are equal to a lexicographic  
reordering permutation of the Walsh code

20 codes have a 1-to-1 sequency~frequency correspondence with  
the DFT codes

codes have 1-to-1 even~cosine and odd~sine correspondences  
with the DFT codes

25 codes take values {1+j, -1+j, -1-j, 1-j}

codes take values {1, j, -1, -j} with a (-45) rotation of  
axes and a renormalization

30 codes have fast encoding and fast decoding algorithms

encoders are implemented in CDMA transmitters for  
representative embodiments as complex multiply channelization

encoding of the inphase and quadrature data replacing the Walsh real multiply channelization encoding of the inphase and quadrature data, prior to covering by long and short complex PN codes

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decoders are implemented in CDMA receivers for representative embodiments as complex conjugate transpose multiply decoding of the inphase and quadrature encoded data replacing the Walsh real multiply decoding of the inphase and 10 quadrature encoded data, after decoupling by short and long complex PN codes

8. A means for the design and implementation of encoders  
15 and decoders for generalized Hybrid Walsh complex orthogonal CDMA channelization codes over a frequency band with properties

codes can be constructed for a wide range of code lengths by combining with DFT and quasi-orthogonal PN codes using tensor 20 product, direct product, and functional combining

codes can be constructed as tensor products with DFT codes and quasi-orthogonal PN codes and other codes

25 codes can be constructed as direct products with DFT codes and quasi-orthogonal PN codes and other codes and with functional combining

codes are complex valued

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codes have fast encoding and fast decoding algorithms

encoders are implemented in CDMA transmitters for representative embodiments as complex multiply channelization 35 encoding of the inphase and quadrature data replacing the Walsh

real multiply channelization encoding of the inphase and quadrature data, prior to covering by long and short complex PN codes

5 decoders are implemented in CDMA receivers for representative embodiments as complex conjugate transpose multiply decoding of the inphase and quadrature encoded data replacing the Walsh real multiply decoding of the inphase and quadrature encoded data, after decoupling by short and long  
10 complex PN codes

9. A means for the design and implementation of encoders and decoders for complex orthogonal CDMA channelization codes  
15 over a frequency band with properties

inphase (real) codes are equal to a reordering permutation of the Walsh code

20 quadrature (imaginary) codes are equal to a reordering permutation of the Walsh code

codes are complex valued

25 codes have fast encoding and fast decoding algorithms

encoders are implemented in CDMA transmitters for representative embodiments as complex multiply channelization encoding of the inphase and quadrature data replacing the Walsh  
30 real multiply channelization encoding of the inphase and quadrature data, prior to covering by long and short complex PN codes

decoders are implemented in CDMA receivers for  
35 representative embodiments as complex conjugate multiply decoding

of the inphase and quadrature encoded data replacing the Walsh real multiply decoding of the inphase and quadrature encoded data, after decoupling by short and long complex PN codes

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10. A means for the design and implementation of encoders and decoders for generalized complex orthogonal CDMA channelization codes over a frequency band with properties

10 codes can be constructed for a wide range of code lengths by combining with DFT and quasi-orthogonal PN codes using tensor product, direct product, and functional combining

15 codes can be constructed as tensor products with DFT codes and quasi-orthogonal PN codes and other codes

codes can be constructed as direct products with DFT codes and quasi-orthogonal PN codes and other codes and with functional combining

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codes are complex valued

codes have fast encoding and fast decoding algorithms

25 encoders are implemented in CDMA transmitters for representative embodiments as complex multiply channelization encoding of the inphase and quadrature data replacing the Walsh real multiply channelization encoding of the inphase and quadrature data, prior to covering by long and short complex PN  
30 codes

decoders are implemented in CDMA receivers for representative embodiments as complex conjugate transpose multiply decoding of the inphase and quadrature encoded data replacing the Walsh real multiply decoding of the inphase and quadrature

encoded data, after recovering by short and long complex PN codes